# PLANT COMMUNITIES OF THE EASTERN SIERRA



Eastern Sierra trees and shrubs reflect the region's topographic and climatic extremes. The steep eastern escarpment, rising as high as 8,000 to 10,000 feet in less than 10 miles, causes major changes in the environmental conditions that trees and shrubs depend upon. In general, precipitation increases, temperature decreases, and winds become stronger as elevation rises. These effects are magnified by the exceedingly steep gradient of the Eastern Sierra.

As environmental conditions change along the elevation gradient, so do vegetation types. Very few plants and trees can establish and survive under wide varieties of environmental conditions; most require specific sunlight, moisture, temperature, and/or soil conditions. The vegetation that tends to grow together under similar environmental conditions is called a *plant community*.

Within this section, plants and trees are classified into broad communities common to the Mammoth Lakes area. These groupings, however, are bound to be somewhat general as plants respond individually to climate change and environmental variables. Thus, variations occur within any given community and some species overlap between communities.

For more information on Eastern Sierra vegetation, explore *references* at the end of this section.

## Sagebrush Scrub Community

Sagebrush scrub is a treeless community of low shrubs stretching across much of the high desert (4,000 to 9,000 feet) and also within the montane forest. It is widely distributed near the base of the Eastern Sierra on lower slopes and glacial moraines, and on low- to mid-elevation slopes of mountain ranges to the east (Glass and White Mountains). Characteristic species include Great Basin (big) sagebrush, rubber rabbitbrush, and antelope bitterbrush. Native bunch grasses, such as Great Basin wildrye, Idaho fescue, and bluebunch wheatgrass, have been decimated by livestock grazing and largely replaced by native perennials and introduced annual grasses.

The understory of this community is often sparse due to the harsh climate and difficult growing conditions. Precipitation ranges from five to 15 inches per year, with most falling as snow in the winter, while summer conditions can be very hot and dry. Soil conditions vary, but are usually well drained.

### Great Basin (big) sagebrush (*Artemisia tridentata* ssp. *tridentata)*

Great Basin sagebrush is the most common sagebrush of the Eastern Sierra. It is a soft, woody, gray-green shrub that grows two to six feet high. The leaves are aromatic and narrow with three rounded teeth. Sagebrush flowers from August through October, with small, yellow flowers appearing in clusters on separate stems.


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### Rubber rabbitbrush (*Chrysothamnus nauseosus*)
Rabbitbrush is a rounded, strongly scented shrub about one to six feet tall. The twigs are covered with dense, felty hairs and the leaves are very narrow. The shrub prefers dry, alkaline soils and low-lying, recently disturbed habitat. Oval clusters of small yellow flowers bloom from August through October, dispersing pollen that often causes an allergic response similar to hayfever. During World War II, latex from this plant was discovered to be a reliable source of high quality rubber.

### Antelope bitterbrush (*Purshia tridentata)*



Bitterbrush is an important food plant for both livestock and native herbivores, such as mule deer and pronghorn antelope. Its height is variable (one to 15 feet), and the leaves are wedge-shaped and three-lobed. Numerous, five-petaled flowers appear from May through July, followed by spindle-shaped, leathery fruits. The shrub reproduces from seed, root sprouts, or by sending out low branches that send down roots. The species is fire intolerant and requires several decades to reestablish after a burn.

## Pinyon-Juniper Woodland Community
Pinyon-juniper woodlands cover slopes in the Eastern Sierra between 5,000 and 9,000 feet and are dominated by shrubby conifers. Single-leaf pinyon is often the only tree species present, although open stands of mixed woodlands can form with western juniper. The understory is typically desert-like, sparsely populated by scattered low shrubs, perennial wildflowers, and grasses common to the sagebrush scrub community. Precipitation measures about 20 inches per year, mostly in the form of snow, and soils are often gravelly and well drained.

The effects of fire are often severe in the pinyon-juniper woodland, resulting in long-term loss of trees due to high mortality and slow regeneration. Pinyon pines are highly flammable, spreading fire quickly through the community despite the open stand structure, and seedlings are slow to reestablish. The result of recent fires can be viewed north of Mammoth Lakes along Highway 395 between the towns of Walker and Topaz.

### Singleleaf pinyon pine (*Pinus monophylla*)



Pinyon pine is a small, gray tree (16 to 30 feet), often shrubby, with a low, rounded crown and a twisted or forked trunk. It grows on dry mountain slopes from 5,000 to 7,500 feet, sometimes surviving with less than 10 inches of rain annually. The dark brown to gray bark often becomes furrowed with age, and the trees are typically well-spaced in open stands.

Unlike other native pines with two to five needles clustered in one bundle, the pinyon has a single needle with a papery sheath at the base. The single needle is actually composed of five separate vascular bundles, suggesting the needles fused from five into one sometime in the past. Their thick-scaled cones are two to three inches long, oval, very resinous, and contain nutritious seeds that are an important food for American Indians and wildlife, including jays, chipmunks, and woodrats. Gum or resin from the pinyon was collected and used by American Indians to help soothe sore throats and as a cure for rheumatism and tuberculosis. Settlers used pinyon to make fencing and timber.

### Western juniper (*Juniperous occidentalis*)
A member of the Cypress family, western juniper is a gnarled, burly little tree that grows 15 to 70 feet tall and has shredded, reddish-brown bark that is often spiraled around the tree. Spiraling is a characteristic found in trees inhabiting harsh, windy areas, possibly providing strength and resistance against the strong winds. The roots of this hardy tree extend through rock crevices, anchoring it to sites where lack of soil, extreme exposure to blizzards, and summer droughts prevent other trees from surviving. Despite these difficult conditions, junipers can live up to two thousand years. One tree near Sonora Pass, named the Bennett Juniper, is conservatively estimated to be three thousand years old.


The western juniper has distinctive features, including minute scale-like leaves on bushy boughs, blue berry-like fruit, and a squatty, gnarled appearance. The fruit matures in the fall and clings to the trees all winter, providing an excellent food supply for mountain wildlife. Wildlife plays a vital role in the dispersal of juniper seeds, which may not germinate unless they pass through the digestive tract of a bird or mammal.

Juniper berries have been used to flavor gin, and the pleasantly aromatic heartwood is highly valued as timber. American Indians made arrow shafts from the tough, heavy wood and fastened the feathers with the resin, while western pioneers used the wood for fence posts.

## Montane Forest Community

Montane forests in the Eastern Sierra (7,000 to 9,000 feet) are typified by tall conifers, mainly pines and firs, but are more open, less extensive, and contain fewer species than the northern and western montane zones. In the Mammoth area, Jeffrey pines occupy drier sites, western white pines and lodgepole pines inhabit moister locations, western juniper survive on exposed ridges, and dense red fir stands develop on moist north-facing slopes. White fir exists in scattered stands. A relatively mild climate protects these species from the extensive wind and snowfall of higher elevations, and summers are relatively long with a four to five month growing season. Unforested sites in this community support montane chaparral, sagebrush scrub, montane meadow, and montane riparian woodland communities.

Montane forests are relatively open under natural conditions that include frequent forest fires, but fire suppression since the late 1800s has allowed undergrowth to flourish. Some forests, especially along the western slope of the Sierra, are now heavily shaded tangles of fallen trees and overgrown shrubs. Because the Mammoth area is extremely dry with poor soils, local montane forests have mostly avoided becoming closed, shady stands.

### Jeffrey pine (*Pinus jeffreyi*)


Dry sites in the Eastern Sierra, such as the pumice soils around Mammoth, support pure stands of Jeffrey pine with a sagebrush and chaparral understory. According to the U.S. Forest Service, the pines cover about 100 square miles, forming the world's largest Jeffrey pine forest.

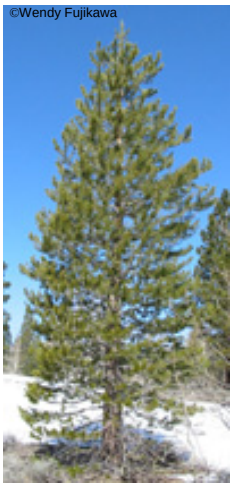
Found at 6,000 to 9,500 feet, Jeffrey pines are tall trees (80 to 130 feet) with gray-green to blue-green needles up to six inches long in bundles of three. It has large, beehive-shaped cones five to 10 inches long with slender, incurved prickles that point downward. The cones open in the fall, allowing the one-inch winged seeds to disperse with the wind. The bark of mature trees is cracked into irregular reddish brown plates, resembling large jigsaw puzzle pieces, often with a distinct vanilla or butterscotch odor. Jeffrey pines are highly tolerant of freezing temperatures, allowing seedlings to establish in cooler habitats than many other conifers.

Jeffery pines, which can live up to 500 years, are often confused with the similar Ponderosa pine, a three-needled pine that grows on the western slope of the Sierra. Like the Ponderosa, Jeffery pines require open stands to germinate and survive, and are highly resistant to fire due to a thick bark and a high crown profile. Frequent, low-burning fires were historically common in Jeffery pine forests, eliminating competition for water and nutrients from fire-intolerant understory shrubs and trees.

Jeffrey pine stands are subject to cyclic infestations of the Pandora moth (*Coloradia pandora*), a forest insect that periodically defoliates many square miles of trees. The protein-rich caterpillars of the moth are called "piüga" (pee-ag´-gee) by the local Paiutes, who traditionally harvested them as an important food source.

In 1867, a turpentine distiller accidentally discovered that Jeffery pine pitch contained a chemical called “abietin,” which contains 96% heptane, a chemical found in petroleum. The pure heptane from Jeffrey pines was used to develop the octane rating currently used for gasoline grades, an important step in the development of combustion engines. Ironically, exhaust from combustion engines is now threatening large stands of Jeffrey pine. Pollution from cars, combined with industrial pollution from major population centers, creates large amounts of ozone, damaging the needles of both Jeffrey and Ponderosa pines. Intensive studies in the 1970s by the U.S. Forest Service indicated that over a million large Jeffrey and Ponderosa pines north of the Los Angeles Basin and in the San Bernardino Mountains were being killed by air pollution.


### Lodgepole pine (*Pinus contorta* ssp. *murrayana*)




Lodgepole pines grow in moist areas – compared to Jeffrey pines – and can form extensive pure stands at 7,000 to 10,000 feet in elevation. In drier climates, they can be found at elevations up to 11,000 feet living with whitebark pine, western white pine, and mountain hemlock. Lodgepoles are very common on Mammoth Mountain and are also known erroneously as tamarack pines, hence the name of “Tamarack Lodge” located on the shore of Twin Lakes in the Lakes Basin.

Lodgepoles are the only pine with needles sheathed in groups of two. The needles are short (about two inches long), fairly stiff, and prickly. Lodgepole pines have relatively straight trunks that taper very slightly, making them ideal for building lodges and shelters. When mature, their bark is grayish, thin, and flaky, with the appearance of oatmeal. A single tree can bear many small cones, similar to golf balls in shape and size, which produce winged seeds dispersed by the wind. Occasionally these cones are serotinous, meaning the seeds are released only when the resin binding the cone together is melted by fire. In the Sierra, lodgepole pines are not dependent upon fire for seed dispersal as cones open (usually in August or September) when solar radiation heats the resin above 113˚F. Chickarees, chipmunks, and nutcrackers are among the forest inhabitants that feed on the seeds.

In the Twin Lakes campground, lodgepole pine stands have recently experienced high mortality rates due to the lodgepole pine dwarf mistletoe (*Arceuthobium americanum*), a parasitic, flowering plant. The mistletoe obtains most of its nutrients and all of its water and minerals from its host, reducing the amount of carbohydrates the tree receives from photosynthesis. Mistletoe seeds are forcibly discharged 20 to 60 feet horizontally through “hydrostatic pressure,” a process where water builds up inside the plant until the pressure becomes great enough to forcibly expel seeds. The seeds are covered with a sticky substance so that they adhere to any surface they contact. Weakened by the mistletoe, the lodgepole pine is more susceptible to infestations of mountain pine beetles (*Dendroctonus ponderosae*).


In 1989, the distribution and intensity of dwarf mistletoe was surveyed and recorded for the Twin Lakes campground by the Mammoth Lakes District of the U.S. Forest Service. Detection of the mistletoe was based primarily on bushy growths of branches, known as “witches’ brooms,” produced by the tree to increase carbohydrate production through photosynthesis. Infestation intensity was assessed using the Hawksworth Rating System, a common system for assessing infection severity. At Twin Lakes, 90% of the lodgepole pines on the western shore were severely infected, and all trees were infected to some degree. On the eastern side, only 20% of the area was severely infected. The Forest Service has begun planting red fir, which is not susceptible to the mistletoe, to replace the infested lodgepole pines. Someday, lodgepole pine will probably not exist at Twin Lakes due to the mistletoe, and the entire population in the Lakes Basin could be affected.

### Western white pine (*Pinus monticola*)

Western white pine grows between 7,500 to 10,500 feet in elevation where the snowpack is deep and the growing season is short. These relatively tall pines (50 to 165 feet) grow in both montane and subalpine forest zones, and are readily identified by narrow, slightly curved cones hanging like banana bunches from the tips of upper branches. In the fall, these six to 10 inch long cones drip pitch profusely (covering cars parked underneath), and sparkle in the sunshine. They only bear a few cones, though, usually every three to four years.

All white pines, including western white pine, whitebark pine, and limber pine, bear needles in bundles of five; one needle for every letter of the pine type, W-H-I-T-E. The slender, soft, blue-green needles are two to four inches long. Branches in the lower part of the crown grow in horizontal, layered tiers while branches in the upper crown arch upwards, creating a distinctive shape. The bark is light gray on young trees, maturing to square or rectangular brownish-orange sections.

Western white pine is considered a valuable timber tree, and requires open conditions to germinate and grow to maturity. Current populations of western white pine are threatened by white pine blister rust, a fungus that was accidentally introduced from Europe in the early 1900s and decimated eastern white pine populations by the mid-1900s. Currant and gooseberry bushes serve as alternate hosts during the blister rust lifecycle.

### Red fir, or silver-tip fir (*Abies magnifica*)

Majestic red firs, with their luxuriant bluish boughs and thick, furrowed, chocolate bark, cover cool northern exposures between 6,500 and 9,000 feet in elevation. Unlike most other trees in the Sierra, large red firs often grow close together in pure groves, their heavy crowns forming a dense canopy that keeps the forest floor shady, moist, and cool. These conditions are ideal for the red fir, which is shade tolerant and fire intolerant. Red firs also form mixed stands with other high elevation conifers, such as Jeffrey pine, lodgepole pine, western white pine, whitebark pine, and mountain hemlock.


Red firs can grow to be 60 to 160 feet tall, with smooth, grayish-white bark on young trees and dark, reddish brown bark on mature trees. Red firs display two characteristics of true firs; the bark contains blisters filled with resin and their barrel-shaped cones grow upright on tree branches and disintegrate while still on the tree, leaving a candlestick-like stem behind. The six to eight inch long cones release large, winged seeds throughout the fall and winter. Red fir needles are short (1.25 inches long) with a slight hook at their base resembling a hockey stick, and are thick enough to be rolled between the fingers, distinguishing it from the white fir needle, which is relatively flat and does not roll easily. New needle growth on the ends of branches in the spring is silver in color, resulting in the moniker “silver-tip.”

The tallest firs are often hit by lightening, leaving damaged crowns and snag tops that provide excellent wildlife habitat. The tops of older trees also frequently snap off in high winds due to a species-specific fungus that eats the heartwood, earning red firs the nickname of “widow-maker.”

### White fir (*Abies concolor*)

Like the red fir, the white fir has upright cones, resin-filled bark, and single needles. However, white fir tends to grow at slightly lower elevations, 3,500 to 7,500 feet, although they can be found up to 10,000 feet. White fir is less common on the eastern side of the Sierra, and tends to grow in scattered stands. It is a shade tolerant species, like the red fir, and tends to grow slowly in the understory until a chance opening in the canopy allows it to grow quickly into a dominant tree.


The most distinct difference between red and white firs is the shape of their needles. White fir needles are semi-flat with a quarter twist at the base. Blue-

green with white lines on both sides, white fir needles are longer (1.0 to 2.5 inches long) than red fir needles. New growth on white fir appears bright green in color, instead of silver. The inner bark of white fir trees is tan and the cones are smaller than the red fir (three to five inches long). Heavy cone crops are only produced every three to nine years, and the seeds provide a favorite food for chickarees, while deer browse on the tender foliage of saplings.

## Montane Riparian Woodland Community

The montane riparian woodland community borders larger streams and many lower lakes of the Eastern Sierra at elevations between 6,000 and 9,000 feet. Important species include broad-leaved deciduous trees like quaking aspen, mountain alder, and willow, along with some montane forest species like lodgepole and Jeffrey pine. These stands typically support a luxuriant herbaceous understory of colorful wildflowers, rushes and sedges, coarse-stemmed horsetails, ribbon-leaved grasses, and lacy ferns.

### Quaking aspen (*Populus tremuloides*)


Quaking aspens are one of the most colorful trees in the high Sierra. In the summer, the leaves are bright green on top and silver underneath, creating dynamic color patterns as they flutter in the slightest breeze. As the weather turns cold, aspens provide brilliant fall colors of yellow, gold, orange, and red. These trees have one of the largest distributions of any tree in North America, and tend to grow in pure stands between 6,000 to 10,000 feet in elevation in the Eastern Sierra. Intolerant of shade and competition from conifers, aspens inhabit the open riparian community and forest edges. They are usually short-lived, relative to conifers, dying at about 60 years old.


Quaking aspens are distinguished from cottonwoods by their smooth, whitish-gray bark, small buds lacking resin, and large (1.25 to 3.0 inch) round leaves that are pointed at the tip. The leaves are borne on long, flattened stalks (petioles), causing them to quiver in the slightest breeze. Aspen trees typically reproduce by sprouting new shoots from the existing root system, although a single grove may produce millions of unviable seeds. The new shoots are genetically identical to all other shoots connected to the same root system, establishing a grove of clones. Responding individually to environmental signals, each clonal group leafs out, flowers, and drops their leaves in a genetically-controlled response to a certain length of daylight (the “photoperiod”) and changing temperatures. The buds, bark, and shoots are a favorite food of beaver and deer, as well as domestic livestock.

### Mountain alder (*Alnus tenuifolia*)

Alder trees grow as deciduous shrubs in the Eastern Sierra and have two unique characteristics; the ability to fix nitrogen and occurrence only along permanent water sources. Specialized nodules in alder roots host bacteria that trap and absorb airborne nitrogen, eventually making the nitrogen available to the tree and enriching the soil. Pure alder stands typically have 23% more nitrogen in the soil. The bacteria receives nutrients from the alder (host plant), while the alder receives nitrogen from the bacteria, a mutual dependency called “symbiosis.” Because alder trees only grow next to permanent water sources, pure stands have the potential to change stream chemistry due to increased nitrogen in the soil.


Mountain alder grows between 4,500 and 8,500 feet in elevation and requires bare soil to establish, such as stream banks after floods. The roots prevent erosion of stream banks and the foliage provides shade and a moist environment for riparian habitat. Alders attain heights of 20 to 50 feet, with smooth gray or sometimes reddish brown trunks. The dark green, coarse leaves are oval to nearly round and two to 3.5 inches long. The flowers grow as separate male and female catkins (dense, elongate clusters of minute flowers without petals), flowering in the spring before

leaves appear. Alder flowers are wind pollinated, with pollen from the dangling male catkins dispersing to the female catkins, which look similar to tiny cones.

### Willow (*Salix* spp.)


About a dozen willow species (trees and shrubs) grow in the Sierra, and differentiating between types can be difficult. Willow trees have straight, slender, brightly colored yellow to reddish twigs, single leaves, and narrow clusters of male and female catkins borne on separate plants. Like the mountain alder, the catkins bloom before leaves appear in the spring.

Willow trees and shrubs are found near streams or in moist areas from 3,000 to 10,000 feet in elevation, depending on the species. Great Basin Indians use willow to make baskets and as pain medication. Willows produce a compound called salicin, which is chemically related to acetylsalicylic acid or aspirin, and was used to treat toothache, stomachache, diarrhea, dysentery, venereal disease, and dandruff.

## Subalpine Forest Community

Subalpine forest plants must withstand conditions almost as harsh as alpine regions. Winters are long and cold with blowing ice and snow, and spring is slow to arrive with the growing season only about eight to 12 weeks long. Such conditions tend to favor conifers, which have a high tolerance for cold, are relatively drought-resistant, and can begin photosynthesizing as soon as spring arrives due to their evergreen foliage. Thus, subalpine forests include lodgepole, western white, limber, whitebark, and foxtail pines, and mountain hemlock. Although these trees sometimes form mixed stands, pure stands of a single species are more common.

Subalpine forests typically occur between 9,000 to 11,300 feet in elevation, with the upper limit marked by treeline. Trees on the bleakest, highest crests are twisted and pruned by furious winds into low, shrubby forms called *krummholz*, a German word meaning “crooked wood.”

### Whitebark pine (*Pinus albicaulis*)


Whitebark pines are small conifers (up to 35 feet tall) found at high elevations between 9,000 and 11,000 feet. The whitebark pine can grow in mixed woodlands with lodgepole, western white pine, and mountain hemlock, but often forms pure stands at treeline.

Whitebark pines grow very slowly, taking as long as 500 years to grow seven inches in diameter. The slow growth rate of subalpine trees is a major reason why wood fires are prohibited above 10,000 feet in the backcountry.

The bark of this pine is chalky white, or silver if wind-whipped. The yellowish-green needles are 1.5 to 3.5 inches long, growing in bundles of five. Purplish cones grow up to three inches long on the ends of upswept branches, maturing in late August or early September of their second year. In early fall, they dry out and turn brown, but do not open to release the seeds like most cones. Instead, birds like the Clark’s nutcracker pry open the cones to extract the seeds. The nutcracker can store up to 100 seeds in a sublingual pouch below its tongue, and then cache them to eat later. Not all seeds are recovered, allowing the buried seeds to germinate and establish new trees. The caches usually contain many seeds and thus many whitebark pines grow close together in clumps, but multiple stems can also arise from the same root system. Krummholtz matts can also spread by “layering,” or by rooting where branches touch the ground, allowing the matts to creep across the landscape.

### Mountain hemlock (*Tsuga mertensiana*)

Known as John Muir’s favorite tree, mountain hemlocks most often grow above 9,500 feet and are easily identified by their bent, drooping tops and graceful boughs. This shape allows the branches to shed snow

easily, enabling hemlocks to survive in areas of heavy snowfall. Like the whitebark pine, mountain hemlock grows in a krummholz form near treeline, sometimes in pure stands. Branches can also be pinned to the ground by the snowpack, forming cave-like thickets that provide winter cover for birds and mammals.


Mountain hemlocks grow slowly due to harsh conditions at high altitudes. A tree with a 20-inch diameter may be 250 years old. Despite slow growth, hemlocks are hardy and can live up to 800 years. The single, round blue-green needles are up to 0.75 inches long and are arranged on branches in unique spur shoots, giving the limbs a soft, bushy appearance. The cones are two to three inches long, and can be so numerous during heavy crop years that they weigh down the branches.

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